

WHAT IS CLAIMED IS:

1. A method for producing a protein suitable for X-ray crystallographic analysis, comprising
synthesizing a protein using a cell-free protein synthesis system comprising a
5 cell extract, a nucleic acid coding for said protein, and amino acids for the substrate of said protein,
wherein said amino acids comprise at least one amino acid comprising a heavy atom, and wherein said amino acid comprising the heavy atom is introduced into the synthesized protein at an introduced rate of at least 80%.
- 10 2. The method of claim 1, wherein said cell-free protein synthesis system consists essentially of an internal dialysate and an external dialysate through a dialysis membrane, wherein said internal dialysate comprises said cell extract and said nucleic acid coding for said protein, and wherein said amino acids for substrates of said protein comprising said internal dialysate and/or said external dialysate.
- 15 3. The method of claim 1, wherein said cell extract is an extract of *Escherichia coli*, thermophilic bacteria or yeast.
4. The method of claim 3, wherein said cell extract is a concentrated extract of *Escherichia coli* S30 cell extract fraction.
5. The method of claim 2, wherein said external dialysate further comprises an
20 ATP regenerating system, a high-molecular weight absorbent and a reducing agent, and wherein said external dialysate is exchanged for a fresh dialysate when the rate of protein synthesis is reduced.
6. The method of claim 2, wherein the fractional molecular weight of said dialysis membrane ranges from 10,000 to 100,000.
- 25 7. The method of claim 1, wherein said cell-free protein synthesis system further comprises a combination of creatine kinase and creatine phosphate as an ATP regenerating system.

8. The method of claim 1, wherein said heavy atom is any one selected from the group consisting of mercury, platinum, iodine, iron and selenium.

9. The method of claim 1, wherein said amino acid comprising the heavy atom is selenomethionine or selenosysteine.

5 10. The method of claim 2, wherein said amino acid comprising the heavy atom is selenomethionine or selenosysteine.

11. The method of claim 3, wherein said amino acid comprising the heavy atom is selenomethionine or selenosysteine.

10 12. The method of claim 4, wherein said amino acid comprising the heavy atom is selenomethionine or selenosysteine.

13. The method of claim 1, wherein said introduced rate of said amino acid comprising the heavy atom is at least 95%.

14. The method of claim 9, wherein said introduced rate of said amino acid comprising the heavy atom is at least 95%.

15 15. A protein produced by the method of claim 1.

16. A protein produced by the method of claim 1, wherein said introduced rate of said amino acid comprising the heavy atom is at least 95%.

17. A protein produced by the method of claim 9, wherein said introduced rate of said amino acid comprising the heavy atom is at least 95%.

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